

LETTERS TO THE EDITOR.

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The Definition of Entropy.

THERE is, I fear, a difficulty in drafting Prof. Bryan's definition so as to be clear as well as accurate. This arises when the definition is first given with reference to the entropy of the working substance, because the non-available energy is not necessarily a portion of the energy of the substance. The terms available energy, free energy, bound energy, and non-available energy are continually used loosely in thermodynamics as if they referred to portions of the energy of the working substance. I know from experience the difficulty of defining the entropy of the working substance in terms of dissipation or degradation, without reference to the state of things outside the substance, and in a paper on the factors of heat I adopted the notion of reduction of "transfer credit," so that increase of entropy went with lessening of capacity for transforming heat into work with change of volume. In my book on "Entropy" the whole treatment is essentially from the dissipation or degradation point of view, but entropy is first defined in connection with the irreversible increase of entropy in an isolated system. It is thus defined: "Increase of entropy is a quantity which, when multiplied by the lowest available temperature, gives the incurred waste."

May I say that I am exceedingly glad to find Prof. Bryan treating the subject from the same point of view, as it is strong evidence that my treatment is essentially right.

41 Palace Court, W.

J. SWINBURNE.

MR. SWINBURNE has directed attention to an obscure point in my letter of November 10 which is calculated to produce quite the contrary impression to what I intended. In defining available energy relative to a given temperature, it was not my intention to exclude work that the system was capable of producing by expansion or otherwise without using the reversible engines, and instead of "maximum amount of energy" I meant maximum amount of work. By work I refer to ordinary mechanical energy as opposed to what Mr. Swinburne calls "waste energy." The point to which I wished to direct attention was the desirability of basing a definition of entropy on non-available energy, and the use of the term "relative" in this connection, or at least some equivalent language (as implied in my words, "The definition may be stated somewhat as follows").

So far as I am able to judge, both from Mr. Swinburne's book and from some correspondence with the author, it would appear that the conclusions to which I am being led by independent working in regard to entropy agree closely in many substantial points with those at which he has arrived. Since the controversy referred to there have been one or two papers published on the subject by other writers with which I altogether disagree.

G. H. BRYAN.

Craniology of Man and the Anthropoid Apes.

In reading Mr. Macnamara's Hunterian oration of February, 1901, I find these words:—

"Prof. Deniker in his work on the embryology and development of the anthropoid apes has shown that in consequence of the early closure of the anterior sutures of the skull of these animals the fore part of their brain does not increase beyond the size it had attained at the end of the first year of life; but in man these sutures do not consolidate until a much later period, so that the anterior lobes of his brain are enabled to expand, and actually become far more perfectly developed than the corresponding lobes among anthropoid apes."

This being so, I ask:—

(1) Has the experiment ever been tried of keeping the sutures of an infant ape open by artificial means? And if it has,

(2) Has the brain been found to expand and become more perfectly developed?

For if so we should expect the ape to manifest an intelligence not far short of that of a man.

A. T. MUNDY.

IN answer to Mr. A. T. Mundy's questions, it seems to me that it would be impossible in a young living ape, by artificial means, to prevent his frontal suture from closing, and if we could succeed in keeping it open I question if any marked increase in the size of the animal's frontal lobes would augment his intellectual capacity. It is not only the great size of man's cerebrum as compared with that possessed by anthropoid apes which gives him greater intellectual power, but, as I have stated in the passage quoted by Mr. Mundy from my Hunterian oration, the frontal and parietal lobes of the human brain are "far more perfectly developed than the corresponding lobes among anthropoid apes." This is especially the case with respect to those motor and psychical areas of man's cerebral convolutions which control his power of intelligent speech; these areas of the brain are deficient in the anthropoid apes. It is probable that man's ability to make use of articulate language, and through this means to think, has led to the great development of the psychical elements of his brain. A comparison of the size and conformation of the cranium of Tertiary man with that of existing Englishmen is an indication of the length of time it has taken for the human cerebrum, and therefore intellect, to reach its present stage of evolution. Man and anthropoid apes we hold to be derived from a common ancestral stock; the former, under the action of natural selection and other causes, including, I think, not only an inherent capacity of cerebral but also of cranial growth, have gradually developed, whereas anthropoid apes, from arrest of cranial and cerebral growth, have not reached the standard attained by human beings; the difference between these two orders of beings, however, is one of degree, and not of kind.

N. C. MACNAMARA.

November 26.

Pinnipedia a Sub-order of Cetacea!

ONE is so much accustomed to encounter strange assertions in regard to zoology in the non-scientific Press that one takes little notice of them; but when one reads under the head of "Science," as may be read in this day's *Athenaeum* (p. 767), a reviewer of Mr. Millais's "Mammals of Great Britain and Ireland" complaining of that work that "Nowhere is it stated, as it should be, that the Sub-order Pinnipedia belongs to the order Cetacea," one is tempted to ask to what end have writers on classification laboured, if such an assertion as this is to pass unchallenged? If, by a slip of the pen, "Cetacea" was written for "Carnivora," one can sympathise with the reviewer, for all are liable to such unhappy accidents; but the general drift of his remarks seems to forbid that charitable construction, for in the preceding paragraph it is expressly stated that the Carnivora, except the Mustelidae, are dealt with in the volume.

F. Z. S.

December 3.

The Late Mr. Assheton Smith.

THE man of ample means, and who is a lover of living creatures, has a great opportunity. Mr. Assheton Smith had this opportunity, and he used it not only to gratify his own pleasure, but to share it with others. There was nothing that he liked better than to go the round of his park with a guest, and to point out and discuss the characters and habits of the animals which he had gathered together from various quarters of the globe. With the late squire such a ramble was no ordinary treat. One felt, too, that in this man the beasts had a true friend, that he had studied them and knew their ways, and that he would do his utmost to make their lot as happy as possible. To such a man science owes a great debt. Not only does he afford the student an opportunity of studying animals in favourable circumstances, but he is able to place material at the disposal of the laboratory and museum when these animals have paid nature's last demand. For a number of years I have had the good fortune to act, as it were, as prosector to his menagerie, and both my students and I have been able to carry out not a few studies in comparative anatomy. Sometimes, playfully, he would accuse me of possessing the "evil eye," as he said that an animal was not likely to survive long should I express a desire to have it eventually

for the college museum. I am grateful that my liking for natural history brought me in touch with him. It is in the small actions of life that one can best read character. A gentleman to the core, he was never fearful of giving himself away by showing the utmost courtesy to the humblest. An unfastened door or gate, a watertap left trickling he would not abide. Everything at the park must be precision and finish to the smallest details. Over his many acts of private charity he ever kept the veil tightly drawn. A few of them have incidentally come to my knowledge, and they reveal the vastness of his sympathy. His many zoological donations, and his gift to the college of a site on the Menai Straits for a biological station for the study of marine life, bear eloquent testimony to his desire to advance science. May the pile to be raised on this fine site—let us hope at no distant date—be at least one grateful tribute to his memory.

PHILIP J. WHITE.

University College, Bangor, November 28.

The Leonid Meteors of 1904.

FROM results of observations of this shower as published in NATURE of November 24 it seems that Leonids were found to be somewhat numerous on the night of November 14. It is to be regretted that those observers who were able to count so many shooting stars on this night had not the following night equally clear, as at Dublin both November 14 and 15, though not to the same degree, proved favourable for observations, and it was on the latter night that the maximum occurred. Owing to the unsuitable weather that appears to have prevailed in many places on November 15, some details of the observations made on the successive nights of the epoch at the same place may prove interesting.

The night of November 14 turned out ideally fine here, the temperature also being very mild for the season. During a watch on this date from 10h. 15m. to 13h. 45m. (Dublin time) 16 meteors were counted, of which 7 or 8 were referred to the Leonid radiant. The meteors, especially the Leonids, did not appear very bright, only 1 of the first and 2 or 3 of the second or third stellar magnitudes having been seen. No particulars of their paths were noted, as doing so might have interfered with the observations of other meteors. Shooting stars were more numerous in the early part of the watch than after midnight, 5 having been counted between 10h. 45m. and 11h., of which 2 shot from the direction of Leo. Another, though feeble, maximum occurred about 13h.; but, as it was considered from the declining meteoric rate that the anticipated miniature shower of this night was already over, observations were discontinued shortly before 14h.

The night of November 15 began very inauspiciously; clouds in the early evening covered the heavens, totally concealing both moon and stars. Subsequently, however, the sky partially cleared at intervals, and when observations were begun at 10h. 15m. passing clouds in the east left clear tracts of considerable area. Though the seeing was thus far from good, yet meteors were considered to be rather scarce, only 1 shooting star, a third magnitude Taurid, having been seen during a watch extending over nearly an hour. About 11h. the clouds passed off, leaving the eastern sky clear until nearly 14h. Meteors now began to be more numerous. A fine Taurid at 11h. 25m. passed down straight towards Leo, which, however, was partly invisible in a bank of fog along the horizon. When about twenty minutes later the "Sickle" emerged clear in the heavens, a succession of fine Leonids left no doubt as to the superior character of the coming display.

From 11h. to 13h. 30m. 32 meteors were counted; at 14h. 55m. the number had increased to 50 meteors, the total result at 16h. 45m. amounting to 60 meteors. But owing to clouds observations were greatly hindered from 13h. 45m. to 14h. 15m., and a second interruption of nearly equal length, arising from the same cause, occurred about 15h. During the last hour of the watch the sky was fairly clear, and it was noted that the meteor shower was now rapidly declining. The majority of the meteors were observed to emanate from Leo as soon as the latter had become visible near midnight.

The shower was also observed at the Paris Observatory on the night of November 15 with the following results¹:—

¹ The results are of course given in Paris mean time.

From 10h. 30m. to 13h. 15m. ... 21 meteors observed
 „ 13h. 15m. „ 16h. 30m. ... 29 „ „
 „ 16h. 30m. „ 17h. 35m. ... No shooting star seen

As no mention is made of the state of the weather, it seems the display terminated very abruptly at Paris, slightly more so than in Dublin or elsewhere, as Mr. T. R. Clapham, on November 15, from 15h. 45m. to 17h. 45m. counted 19 Leonids with 3 three doubtful ones, notwithstanding two brief interruptions from clouds, this result, it may be added, indicating a meteoric rate almost exactly equal to that of the preceding night as given by Mr. Hector Macpherson, who on November 14, from 15h. to 18h., recorded 35 meteors (*English Mechanic*, November 25, p. 365). The rate on the latter night seems, however, to have been even higher than this to judge from some results, but more observations are, no doubt, desirable.

JOHN R. HENRY.

Dublin, November 29.

Blue-stained Flints.

Two years ago I found large patches of an intense blue colour, with some black spots, on flints on the quay at Great Yarmouth. I looked for a possible cause, and discovered other patches similar in all respects but colour. The latter patches were black, and had been made by tar spilt by fishermen when tarring their fish skips. I kept some pieces, both black and blue, in a box until some months ago, and no appreciable change had taken place, so I came to the conclusion that the blue colour was produced by the action of the tar on the flint when exposed to sunlight.

This occurrence is interesting in view of the action noticed by Dr. Allen between gas-lime and flint, and points to the action on the flint of some substance common to the tar and gas-lime.

May I suggest to your former correspondent that the blue flints seen at Bournemouth were produced from the black, and not *vice versa*.

THOMAS L. D. PORTER.

County School, Ilford, Essex.

"FIND" OF ROYAL STATUES AT THEBES.

THE "land of surprises and paradoxes," as Egypt has well been called, has once again justified its reputation, and out of the ruins of one of its most ancient cities there has come to light a mass of historical evidence which, if we mistake not, will be found to be of more importance the more it is studied. It will be remembered that for many years past M. G. Legrain has been carrying out a series of repairs of a very far-reaching character on the mass of buildings of various styles and ages which is commonly known as the "Temple of Karnak." In the course of this work he has collected a number of important facts which, when duly arranged, will be of considerable use to the student of ancient Egyptian architecture, and, side by side with these, he has brought together a considerable amount of information of value historically. It is not our purpose even to outline the broad facts of the works of restoration which he has carried out, and we therefore pass on to state briefly the facts which relate to his last "find" of monuments at Karnak.

Early in the present year M. Legrain was continuing the excavation of a portion of the temple precincts near one of the great walls when he accidentally came upon a large pit or well which, it was evident, had been filled up by the ancient Egyptians. Soon after he began to dig out the well the workmen came upon a layer of statues made of hard stone of various kinds, and when the mud was removed from them many of them were found to be inscribed. Beneath this layer of statues was a layer of earth, and beneath the earth was another layer of statues, and the clearing out of the pit showed that it was filled with layers of statues and earth, arranged alternately. The statues were usually found face downwards, and it thus became